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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/785,234	02/24/2004	Thomas W. Oakes	OAK-01	1047

7590
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01/02/2008

EXAMINER

WILKINS III, HARRY D

ART UNIT	PAPER NUMBER
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1795

MAIL DATE	DELIVERY MODE
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01/02/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/785,234

Applicant(s)

OAKES, THOMAS W.

Examiner

Harry D. Wilkins, III

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 November 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-20,23-27 and 29-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-20,23-27 and 29-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 15 October 2007 has been entered.

Rejection Status

2. The rejections of claims based on prior art are withdrawn in view of Applicant's amendments to the claims. In particular, Nakata et al fails to teach extended anode and cathode strips. Instead, Nakata et al requires use of individual electrode points as part of the structure of the photovoltaic cell.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 30 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification, as filed, does not fully support a

claim limitation that the membrane was composed of Nafion® (sulfonated tetrafluoroethylene copolymer). The application as filed merely stated that the membrane utilized was obtained from DuPont Chemical Co. However, DuPont Chemical Co. sells more than one type of membrane, not just Nafion®, and these other membrane types are not made from sulfonated tetrafluoroethylene copolymer. Thus, Applicant has failed to provide a factual showing that the specification as filed supports a claim that includes the limitation that the membrane was made from sulfonated tetrafluoroethylene copolymer.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 4-12 and 31-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kelly et al (US 2005/0178427) in view of Yamazaki (US 4,528,252).

[Kelly et al was filed as application 11/046,572 on 28 January 2005, which is well after Applicant's filing date. However, Kelly et al claim priority to a provisional application, 60/545,374, filed on 18 February 2004, which is six days prior to Applicant's filing date. The '374 application (viewable from Public PAIR) does not contain figure 6, but does contemplate making rigid cells using Plexiglas® (see paragraph [0040]). This teaching corresponds to the teaching in the publication of the '572 application at

paragraphs [0043]-[0044]). Therefore, the effective filing date of Kelly et al is considered to be 18 February 2004.]

Kelly et al disclose (see figure 6) a device for generating hydrogen gas comprising an elongated vessel (6) having a proximate end and a distal end, the vessel hold an electrolyte solution, a divider (2) for separating the vessel into an area (A) designated as a chamber and an area (B) not in the chamber, an elongated cathode strip (3) located in the chamber and positioned within the electrolyte solution, the cathode substantially extending the length of the chamber, an elongated anode strip (4) in the vessel but not in the chamber and positioned within the electrolyte solution, the anode substantially extending the length of the vessel, a hydrogen gas collection area in the chamber (upper regions of area A), a hydrogen gas exhaustion arrangement coupled to the gas collection area (not shown, but provided for by the designation of "H₂" leaving the area A) and an electric source connected to the cathode and the anode wherein the electric source included a photovoltaic cell (5) in the vessel.

Thus, Kelly et al fails to disclose a membrane that divides the entire length of the vessel. Instead, Kelly et al disclose a barrier (2) which leaves open a bridge area for transmission of ions between the anode and cathode.

Yamazaki teaches (see figures 1 and 2 and col. 3, line 24 to col. 7, line 44) that in similar photoelectrolysis systems, it was known to provide either the small open area for bridging the anode and cathode chambers (fig. 1) or to completely separate the two areas using an ion-exchange membrane (fig. 2). Although not expressly taught by Yamazaki, one of ordinary skill in the art was aware that the advantage to using the ion-

exchange membrane would have been providing a complete seal between the two chambers with respect to gases to prevent any hydrogen and oxygen gas mixing.

Therefore, it would have been obvious to one of ordinary skill in the art to have adapted the apparatus of Kelly et al to substitute for the barrier (2), an ion-exchange membrane, as suggested by Yamazaki for the purpose of preventing the produced hydrogen and oxygen gases from mixing across the open bridge area at the bottom of the barrier of Kelly et al. The membrane would have extended from the proximate (bottom) end of the vessel to the distal (top) end of the vessel to ensure complete separation of the hydrogen and oxygen gases.

Regarding claims 4-6, Kelly et al teach the concept of providing a curved vessel wall such that the wall and electrolyte acted to concentrate sunlight onto the photovoltaic cell to enhance the energy efficiency of the device.

Regarding claims 7-9, the device of Kelly et al would have been capable of operating with any electrolyte. As per MPEP 2114 and 2115, apparatus claims are limited by the claimed structure, not in what material is placed within the structure. As such, the limitations of claims 7-9 have not been given further patentable weight.

Regarding claim 10, the membrane of Yamazaki was arranged to form an oxygen chamber, with the anode arranged within the oxygen chamber.

Regarding claim 11, although both Kelly et al and Yamazaki teach only a single anode chamber and a single cathode chamber, duplication of parts has been considered to be an obvious variation absent a showing of unexpected results. See MPEP 2144.04.VI.B.

Regarding claim 12, the device of Kelly et al included an oxygen gas collection area in the oxygen chamber and an oxygen gas exhaustion arrangement coupled to the oxygen gas collection area.

Regarding claims 31-33, Kelly et al teach using a nickel metal strip and a platinum-group metal coated nickel metal strip as the electrodes.

Regarding claims 34 and 35, Kelly et al teach (see paragraph [0013] of the '374 application) that the minimum voltage required was 1.23 volts to split water, but had to be higher to overcome over-voltage effects. Therefore, it would have been obvious to one of ordinary skill in the art to have optimized the voltage applied to the anode and cathode in order to be above the threshold voltage to initiate water electrolysis and to overcome any over-voltage effects that would prevent the reaction from occurring.

7. Claims 3 and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kelly et al (US 2005/0178427) in view of Yamazaki (US 4,528,252) as applied above to claim 1 and further in view of Dederick (US 5,512,787).

Kelly et al teach using only the solar panel as the means for generating the electric current for running the electrolyzer.

However, it was well known that solar panels only generated electricity during the day when the sky was sufficiently devoid of clouds.

Dederick teaches (see Figure 1A and abstract) the concept of using other renewable energy sources, such as solar panels, wind generators and wave action generators for powering an electrolyzer to reduce the need for fossil fuels to generate

the required electricity. Further, Dederick shows (see Figure 1A) switching gear for using any of a plurality of power sources in combination.

Therefore, it would have been obvious to one of ordinary skill in the art to have used an external renewable energy source, such as an additional solar cell, a hydroelectric plant or a wind turbine to provide the electric power necessary to operate the electrolyzer because Dederick teaches that using such renewable resources reduced reliance on fossil fuels.

8. Claims 13, 14, 23, 26, 27, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kelly et al (US 2005/0178427) in view of Yamazaki (US 4,528,252) as applied above to claim 1 and further in view of Dempsey et al (US 3,870,616).

Yamazaki fails to disclose the exact nature of the ion exchange membrane.

However, one of ordinary skill in the art, in the absence of such detail, would have looked to similar water electrolyzers for the purpose of determining a proper membrane to use.

Dempsey et al shows (see paragraph spanning cols. 2 and 3) the conventional use of Nafion[®] membranes to separate an anode chamber from a cathode chamber in a water electrolyzers to allow separate collection of the produced hydrogen and oxygen gases.

Therefore, it would have been obvious to one of ordinary skill in the art to have made the device of Kelly et al with an ion exchange membrane made from Nafion[®] (a conventional polymeric membrane made from sulfonated tetrafluoroethylene copolymer,

that conducted protons and not electrons and was substantially impermeable to gases) because the Nafion[®] was conventionally known within the art of water electrolyzers to have the appropriate properties to separate anode chambers from cathode chambers.

Regarding claim 23, the electric source included a solar cell (5) in the vessel and positioned so that light can pass through the transparent cover, the electrolyte solution and onto the solar cell. Further the device included power conduits for connecting the solar cell to the anode and cathode so that electricity generated by the solar cell drove an electrolysis process.

Regarding claims 26 and 27, Dempsey et al suggest making the anode and cathode from a platinized screen containing a catalyst of platinum and iridium. Therefore, one of ordinary skill in the art would have been led to have utilized the composite platinum and iridium composition disclosed by Dempsey et al for the purpose of providing adequate catalytic activity to perform the water electrolysis reaction.

Regarding claim 29, it would have been within the expected skill of a routineer in the art to have chosen an optimal membrane thickness to balance the ease of conducting protons (conductivity increases with decreasing thickness) with the ability to prevent mixing of the oxygen and hydrogen gases (ability to keep the gases separate increases with increasing thickness).

9. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kelly et al (US 2005/0178427) in view of Yamazaki (US 4,528,252) as applied above to claim 1 and further in view of Russell (US 4,052,228).

The teachings of Kelly et al and Yamazaki are described above.

Russell teaches (see col. 1, lines 48-59) the concept of adding a cooling device in thermal communication with the electrolyte to ensure that efficient operation occurs.

Therefore, it would have been obvious to one of ordinary skill in the art to have added a cooling device in thermal communication with the electrolyte and coupled to the electric source.

10. Claims 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kelly et al (US 2005/0178427) in view of Yamazaki (US 4,528,252) as applied above to claim 23 and further in view of Dederick (US 5,512,787).

Kelly et al teach using only the solar panel as the means for generating the electric current for running the electrolyzer.

However, it was well known that solar panels only generated electricity during the day when the sky was sufficiently devoid of clouds.

Dederick teaches (see Figure 1A and abstract) the concept of using other renewable energy sources, such as solar panels, wind generators and wave action generators for powering an electrolyzer to reduce the need for fossil fuels to generate the required electricity. Further, Dederick shows (see Figure 1A) switching gear for using any of a plurality of power sources in combination.

Therefore, it would have been obvious to one of ordinary skill in the art to have used an external renewable energy source, such as an additional solar cell, a hydroelectric plant or a wind turbine to provide the electric power necessary to operate the electrolyzer because Dederick teaches that using such renewable resources reduced reliance on fossil fuels.

Response to Arguments

11. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Interference

12. The examiner notes that the filing date of the Kelly et al reference is only six days prior to Applicant's filing date. Applicant should take notice that a possibility of copying claims to provoke an interference may be warranted should any claims from the Kelly et al application become patented.

Conclusion

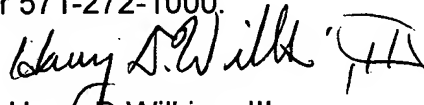
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D. Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-F 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Susy Tsang-Foster can be reached on 571-272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Harry D. Wilkins, III
Primary Examiner
Art Unit 1795

hdw